Claims

We claim:

1. A method for dynamically allocating bandwidth to traffic having a variable data rate in a network, comprising:

measuring a data rate of the traffic received from the network during fixed length time intervals;

grouping a predetermine number of consecutive data rates into overlapping vectors;

applying a discrete wavelet transform to each overlapping vector to determine frequency bands for each vector;

analyzing the frequency bands of each vector to determine an associated energy of the data rate; and

allocating the bandwidth to the traffic according to the associated energy when the traffic is transmitted.

2. The method of claim 1 wherein the bandwidth is allocated in a weighted fair queuing process.

3. The method of claim 1 wherein the bandwidth is allocated in a quality-of-service management block of the network.

4. The method of claim 1 wherein a clock sets time intervals $\sum_n \delta(t-nT)$ at a clock rate of $\frac{1}{T}$ for a data counter.

5. The method of claim 1 wherein the predetermine number of consecutive data rates are grouped into the overlapping vectors in a shift register of length eight.

6. The method of claim 1 wherein the discrete wavelet transform is performed by a Haar wavelet filter bank.

7. The method of claim 1 further comprising:

receiving buffer statistics and a minimum non-zero data rate as feedback while allocating the bandwidth.

8. The method of claim 1 wherein each overlapping vector is in terms of $\underline{\mathbf{X}}_{\mathbf{k}} = [X(n-M+1)\ X(n-M+2)\ ....\ X(n)]$, where M is eight, and n is an instance in time.

9. The method of claim 1 wherein an average data rate for M consecutive time intervals is

$$\underline{\mathbf{X}}_{\mathbf{k}+\mathbf{1}} = 1/2.[X(n\text{-}M+1)+X(n\text{-}M+2)\ X(n\text{-}M+3)+X(n\text{-}M+4)\ .... X(n\text{-}1)+X(n)]$$

at a time scale of $k+1$, and a difference of data rates between two consecutive time intervals is

$$\underline{\mathbf{Y}}_{\mathbf{k}+\mathbf{1}} = 1/2.[X(n\text{-}M+1)-X(n\text{-}M+2)\ X(n\text{-}M+3)-X(n\text{-}M+4)\ .... X(n\text{-}1)-X(n)]$$

where n is a time instance, k is a time scale, and M is an integer.

10. The method of claim 1 wherein the associated energy is expressed as $\underline{\mathrm{E}}_{\mathrm{n}}[E_{1,n},[E_{2,n},...,[E_{k,n}]$.

11. The method of claim 1 wherein a sum of the energies in each frequency band is bounded by a total energy of the traffic.

12. The method of claim 1 wherein the traffic is at a constant bit rate when the energy in high frequency bands is zero, the traffic rate is increasing when all the energy is within a low frequency band, and the traffic rate is decreasing when the energy in the lowest frequency band is decreasing and the energy in the high frequency band is stable.